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PREPARING MEAT FOR WEAK STOMACHS.

A WEAKENED condition of the organs of digestion may be productive of loss of appetite and consequent debility, with wasting from actual want of food; or is perhaps merely attended with a deficient power to digest properly, the appetite remaining tolerably good. Again, an irritable condition of the stomach will cause pain after meals, and an uncomfortable sensation of fulness often relieved by vomiting, and followed by prostration and lowness of spirits, showing that digestion does not take place as it should. Such patients may have tried and given up most kinds of food which they have not found to agree with their stomachs, and confined themselves to milk and beef tea.

Perhaps their appetite is pretty good, but they dare not eat, and the consequence is a state of considerable emaciation and general debility.

A disordered state of the stomach, preventing more or less the digestion of food, is frequently but a symptom, and in fact but a participation of the organs of digestion in the general diseased or weakened state of the body, as happens in fevers, and so often in consumption.

Dr. Pollock remarks,* "In very few instances does any consumptive patient escape without irritation, or even ulceration, of the mucous tract. There are cases, chiefly of the continuous rapid variety, in which the gastric symptoms form the leading features, and impress from the very first a specific character on the disease. . . . Affections of the gastro-intestinal mucous membrane in phthisis, exercise a powerful influence on the progress of the disease. As an actual and proximate cause of death, they are probably more fatal than the lung disease itself. The early stages of acute phthisis are, in many instances, more marked by gastric than by pulmonary symptoms; and certainly

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* "Elements of Prognosis in Consumption," p. 312.

the former cause more distress, and depress the vital powers more rapidly, and to a greater extent than the latter. The thirst, anorexia, red tongue, nausea or vomiting, and irritative diarrhœa which accompany the continuously progressive phthisis, are as characteristic of the disease as are hectic cough and hæmoptysis. In the latter stages of all forms of phthisis, the breaking-up period of old deposits, and in the intervals or pauses of the lung affection, this irritation of the mucous surface is often found as a most destructive agent, which in its milder forms keeps the patient at an habitually low average of strength, and in its more severe precipitates a fatal issue; which, but for this complication, might have been long delayed."

Dr. Chambers also alludes to the indigestion of animal food and frequent vomiting in pulmonary consumption.*

We have now, but in very exceptional cases, nearly given up bleeding and advising low diets, but what is to be done when nothing but beef-tea can be digested? and how are we to keep the body properly nourished in such cases as those I have just stated?

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* "The Indigestions."

Beef tea alone cannot do much towards the maintenance of the body, as it contains no albumen, which is the material blood requires for the formation of flesh. We may surmise that beef-tea can indirectly and for a short time make flesh, by supplying certain materials to the blood which enables the albumen in store within it to be taken up by the tissues, so that they may, temporarily, for a short time, be formed anew, according as they are wasting away. Supposing no food but beef-tea to be taken during an attack of fever, it may be assumed the body will be nourished for a time; but when the supply of albumen in the blood is exhausted, some of this material must be returned to it in the form of albuminous food, or an actual state of starvation must ensue. Now milk is of all kinds of albuminous food that which is most easily digested, and milk and beef-tea may nourish the body; still, in many cases milk does not agree. The stomach is too weak to digest meat in any form, and the greatest difficulty is found to select a diet calculated to suit the debilitated state of the stomach, and of such a nature as will efficiently support the body throughout the illness.

In consumption, and all other chronic wasting

diseases, the most efficient means of staying the progress of the disease is by feeding the body. We frequently see consumptive patients with one lung utterly impervious to air, and the other in some measure useless, continue comparatively well so long as they can take food and digest it properly. Among other benefits conferred by a winter residence in warm climates, the improvement in the appetite and powers of digestion are greatly advantageous to the patient.

I have just now under my care, H. P., aged 35, who in the beginning of March had large cavities in the top or apices of both lungs, those caverns secreting pus, which was abundanly expectorated, as revealed by the microscope; the left lung was in a great measure, if not entirely, impervious to air, and the breathing in right lung was deficient. There was also fever and diarrhœa, with such an amount of weakness that, during one of my visits (on March the 16th) he nearly fainted, which, had it occurred, would have been fatal, and I had to rouse him with ether and wine; he also suffers from albuminuria. At the present time (end of April) this patient has greatly improved; the expectoration has diminished, and is not so puru-

lent; the respiration in right lung is free, except at the apex, although still rough in places, and accompanied with slight sibilus; and the dulness on percussion over left lung is much lessened; he can get up, dress, and go out for a few minutes when the weather is fine; in short, he is mending in a very remarkable degree.

The steel and quinine, and cod-liver oil, this patient had been taking, has probably contributed to his improvement; but it is certainly due principally to his appetite and digestive powers having been very tolerably good during his illness. Even when in the worst stage he took beef tea, milk, arrowroot, sponge cakes, and wine. On the 26th March he had begun to improve, and according to his own statement, which I feel assured can be relied upon, he took for breakfast two eggs, two cups of tea, and three slices of bread and butter; at 11 A.M. a glass of wine; at noon about half a pint of beef tea; at 1 o'clock dinner, consisting of a small mutton chop, with mashed potatoes, and one glass of wine; at 5 P.M., a cup of tea; at 8 P.M. a glass of wine and a piece of bread; at 9 P.M. about three quarters of a pint of beef tea, with a little bread in it; at 10 P.M. a glass of wine and a small piece of

bread; at 2 A.M half a pint of beef tea; and he took the juice of three oranges during the night. This food was thoroughly well digested. Notwithstanding the urgency of the symptoms, there is not much emaciation, and he is now recovering his strength much more rapidly than could possibly have been anticipated. No doubt this patient's life has been saved, so far, from his being able to take food and digest it. I have often thought that if there were a means of preparing meat, so as to enable its easy digestion by weak stomachs, a great boon might be conferred on a very large class of sufferers; and it has occurred to me that by submitting cooked meat to some process similar to that which it undergoes in the stomach, food thus prepared would require but very little effort of the stomach to complete its digestion, and thus the body could be efficiently nourished, notwithstanding a debilitated condition of the digestive organs.

Let me be allowed to introduce the subject by referring shortly to the phenomena of digestion.

We know the function of digestion to be carried on chiefly by means of gastric juice and pepsine. The peristaltic motions of the stomach triturate the

whole together in presence of air, the food becoming thereby pulpy, when it is forced into the intestines or duodenum through the narrow intestinal opening of the stomach. This passage of the digested food into the duodenum takes place in a gradual manner, and must in a great measure depend upon the speed with which the contents of the stomach are transformed into the pulpy condition it is found to have assumed as it enters the intestines. As soon as food has reached the stomach, an acid fluid—gastric juice—is secreted; the rate of the secretion, and its degree of acidity, being apparently regulated by the requirements of the food taken. The fluid is secreted during the whole time food is undergoing digestion. At first the secretion takes place rapidly, but the fluid is weakly acid; as digestion proceeds, the gastric juice gradually becomes more and more acid, although less abundantly formed, a fact, which, I believe, I was the first to observe.* Taking into account the above considerations, it is obvious that the most digestible parts of food are digested first,

* A Discourse delivered to the Fellows of the Chemical Society. "The Journal of the Chemical Society," 1862.

these requiring the weakest acid; while the less digestible parts of food are, for a time, left unacted upon; and according as the food attains the pulpy condition, it is carried into the duodenum. Once in the intestines, the gastric juice is reabsorbed; thus we have a flow of gastric fluid from the stomach into the duodenum, and back again into the blood. The food remaining last in the stomach will be the least digestible, but the strongest gastric juice is then secreted—an admirable provision of nature to guard against indigestion.

Meat undergoes a complete change in the stomach, and, with the exception of some microscopical shreds of muscular tissue, there is nothing to the eyesight in the pulp the duodenum contains, to recal its origin; in fact, the meat has undergone a thorough disintegration, and, in a great measure, a process of solution.

This solution obviously contains the so-called juice of flesh, or extract of meat, or soup; but, moreover, it includes the albumen and a certain proportion of the tissue which meat or flesh is made of.

The process of cooking is nothing more or less

than a first stage of digestion. This may appear remarkable at first sight, as cooked meat is harder than raw flesh; and, indeed, many have the idea that meat—underdone—is more easily digested than when thoroughly cooked. This is an error. By cooking, animal food undergoes the same change it would have to undergo at first in the stomach if eaten raw, due to the coagulation of the albumen it contains. Thus, an egg eaten raw is coagulated in the stomach, and assumes much the same state as when hard boiled; but it is afterwards redissolved, and converted into the same kind of substance as that which results from the digestion of meat. But, in addition to the coagulation of its albumen, meat is subjected to a further change by the process of cooking, which may be considered as the beginning of that process of disintegration and solution which, under any circumstance, is carried on in the stomach. Meat becomes softened by roasting, which can be due to no other cause than the action of the juice contained within it; this fluid, like gastric secretion, being acid.

The remarkable fact that boiled meat is less tender than roast meat, is obviously due to the acid

juice of the meat being withdrawn from it when boiled, and consequently prevented from exerting any softening or dissolving power. In the case of roast meat, the juice remains nearly entirely within it. The cook takes care to pour occasionally over the roasting joint the savoury juice dripping from it, thereby not only adding to the flavour of the meat, but improving its fitness for digestion by making it more tender.

From the foregoing remarks it will be readily understood that, by cooking, our meat is subjected to a process it actually has to go through in the stomach of carnivorous animals, which take their food raw.

The acid of the gastric juice is, from our best authorities, *hydrochloric acid.* My own observations certainly appear to show the invariable presence of hydrochloric acid in that fluid. But this acid is not sufficient by itself to effect in the stomach the digestion of food, and the process requires the simultaneous action of the acid and another substance called *pepsine.* This substance is formed in the mucous coat of the stomach, and is supplied therefrom to the food undergoing digestion. These two substances

—pepsine and gastric juice—intimately mixed with the food in presence of air, convert it into a pulpy mass, which, in from two to eight hours, has found its way from the stomach into the intestines. I have not alluded to the remarkable change which fats undergo in the stomach, being partly converted, as I have shown, into fatty acids.* Enough has been said to make the reader understand the importance and mode of action of my method for the preparation of meat for weak stomachs.

The object of this process is to extend the preliminary digestion of meat one stage further than is done by cooking, before it is taken into the stomach, thereby relieving this organ from the task of carrying out, unassisted, the digestion of cooked meat. Hydrochloric acid and pepsine being the principal agents for the digestion of meat in the stomach, I have thought these substances might be applied to digest cooked meat in some degree previous to its being eaten, and that by giving the stomach animal food, thus softened and dissolved,

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* Proceedings of the Royal Society, 1858.

sufferers from diseases of nutrition, causing wasting and emaciation, and who can take but little food, which they have much trouble in digesting, and others miserably tormented with dyspepsia, whose irritable stomachs cannot digest animal food, let it be ever so carefully cooked, might be enabled to take a little meat, and digest it well, the stomach being saved a certain amount of work. Dr. Bence Jones* explains "why unirritating food, in the finest state of division, and in moderate quantity, can prevent and cure that form of indigestion which depends on an over-irritable state of the mucous membrane of the stomach."

This food contains all the constituents of beef-tea, and albuminous substances besides, although it only supplies a portion of the nourishment possessed by the meat which has been used for preparing it. I believe that when the tissue metamorphosis takes place very slowly, as is usually the case in disease, while beef-tea alone is capable of supporting the body but for a short time, the extract of meat prepared by the subjoined process will give enough nourishment

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* "Animal Chemistry," p. 15.

for the body until the digestive organs can resume their healthy functions. I also feel assured that in most cases where beef-tea alone could be digested, meat prepared by my process will be found digestible.

In addition to the digestible qualities of this food, it is possessed, and this is a very important consideration, of an excellent taste. Having prepared equal quantities of beef-tea or soup, and of my digestible meat, from equal weights of beef, while the beef-tea had but a weak taste, the digestible meat had a strong and savoury genuine taste of good beef-steak.

The food obtained by my process is a fluid holding in suspension a light pulpy substance, most of which, when the liquid is allowed to remain undisturbed in a glass, is seen to fall to the bottom; it is, in a great measure, to this substance that its nutritious properties are due; but the pulpy mass is so minutely divided and so soft, as to be swallowed unperceived. I have given some of the food to several medical friends, and they have declared it excellent. Invalids also find it very good. No difficulty attends the preparation of the meat; it merely requires some hydrochloric acid,

pepsine, and carbonate of soda. The pure hydrochloric acid found in commerce answers the purpose well. This acid, specific gravity 11496, holds in solution 30·174 per cent. of dry hydrochloric acid. The solution fit for use should contain only about 0·4 per cent. of the dry acid, which is a little stronger than gastric juice.* For convenience sake I recommend a solution of twice this strength, which is to be diluted with an equal bulk of water when required:—

Of commercial pure hydrochloric acid, specific gravity 1·1496, take

1856 grains, which dilute with water to 1 gallon, or

232 ,, which dilute with water to 1 pint, or

116 ,, which dilute with water to ½ pint (10 ounces) or a solution of any volume to be made with a proportional weight of acid.†

The amount of the acid solution, prepared as above, should be for one pound of meat (weighed

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* I have found the acidity of gastric juice to correspond to between 0·085 and 0·303 per cent. of hydrochloric acid. It may possibly be an advantage to use a weaker acid than that recommended above. I am engaged at present investigating that subject.

† I subjoin a table showing the weight of hydrochloric acid in

raw), half a pint, or ten ounces, carefully measured and diluted with as much water.

I have found a dose of fifteen grains of pepsine (Boudault's pepsine) for each pound of meat weighed raw to be efficient, but it might perhaps be modified with advantage.

The carbonate (dry proto-carbonate) of soda is easily procured; the dose necessary for one pound of meat (weighed raw), or to neutralise ten ounces of the acid solution, will be 51 grains, or should the ~~crystallized~~ bicarbonate of soda be used, the

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grains to be used for one pint of the solution, according to different specific gravities of commercial pure hydrochloric acid :—

Specific Gravity of the pure Commercial Acid.	Per-centage of Dry Acid.	Weight of Hydrochloric Acid for a Pint of the Solution.
1·1620	32·621	214·6
1·1578	31·805	220·1
1·1537	30·990	225·9
1·1496	30·174	232·0
1·1452	29·359	238·4
1·1410	28·544	245·2
1·1369	27·728	252·5

The specific gravities and corresponding per-centage of dry acid are taken by Ure, and extracted from "A System of Instruction in Quantitative Chemical Analysis," by C. R. Fresenius. Third edit., p. 514.

I should advise druggists not to rest satisfied with the specific gravity of their pure commercial acid, but to ascertain precisely its strength by volumetric measurement with an alkaline solution.

quantity required to neutralise an equal amount of the acid solution will be 81 grains; consequently, to prepare one pound of meat will be required:—

½ pint (or ten ounces) of the dilute acid,

15 grains of pepsine,

51 grains of dry carbonate of soda, or 81 grains of ~~crystallized~~ bicarbonate of soda.

In order to avoid any difficulty or mistake in the preparation of the above materials, I have requested Mr. Squire, of Duke-street, Grosvenor Square, to be prepared to supply the proper dose of the above materials, which he informs me he will be able to do at the very reasonable rate of one shilling per quart bottle of the acid, one shilling per drachm (60 grains) of pepsine, and one penny for every dose of carbonate of soda, the cost for preparing one pound of meat being sevenpence. The heat at which the process is carried on should be as near as possible that of the living body, as higher temperatures retard, or may even arrest the action of pepsine. I had a little trouble in devising some convenient means of attaining this object, but can now recommend a simple plan which

answers the purpose very well. I have had a common tin case made, one foot in length, nine inches in breadth, and two inches deep, and supported upon four legs, with a hole in the upper part to allow of water being poured in and steam to escape. A slip of glass, about one inch long and half an inch broad, is fixed into one of the sides of the box, and acts the part of a window through which the height of the water, which is kept boiling in this little boiler, can be readily ascertained. (See the woodcut.) When required for use it is about two-thirds filled with boiling water, and a gas (a Bunsen's gas-burner) or spirit lamp being placed underneath, will emit sufficient heat to keep the water boiling. On this very simple boiler I place the jars containing the meat and fluid. I have found the common brown earthenware jars with cover (four inches broad at base and seven and a-half inches high—see woodcut) sold at about tenpence each in crockery shops, to suit very well. Each of these jars is just of the proper size to operate upon one pound of meat, and two of them can be placed together on the boiler. This arrangement is so perfectly adapted to the object required, that after allowing jars

charged with the materials to prepare one pound of meat to remain for more than three hours upon the boiler in which water was kept boiling during that time, the temperature of the contents of the jars had risen but a few degrees above the temperature of the body.

The tin boiler cost me 3s. 6d. I have had smaller ones made for 2s. 6d. With the materials at hand, the following is the process to be adopted:—

Take a pound or more of raw beef or mutton, quite fresh, and free from fat. Mutton and beef should be roasted, not boiled; and beef-steak is to be broiled, or done on the gridiron as usual; then mince the cooked meat as fine as possible, and place it in the earthenware jar, or a jug if such a jar cannot be obtained—*metal vessels ought not to be used.* Now take for every pound of meat (weighed raw) ten ounces of the acid fluid, carefully measured, add to it as much water, and then mix one of the pepsine powders with the fluid, finally pour the fluid over the meat in the jar, and let it stand on the boiler for about three hours, stirring frequently the mixture with a wooden or silver spoon. If the food

be required for immediate use, add for every pound of meat (weighed raw) one of the powders of carbonate, or of bicarbonate of soda, transfer the contents of the jar to an earthenware pipkin,* which is preferable to a saucepan, and boil for two or three minutes, either on the fire or on the gas lamp used for heating the boiler; in this case an iron tripod being employed as a stand; finally, strain through a common strainer, using some degree of pressure with a spoon or pestle, so as to separate the pulp as completely as possible, and obtain it in the fluid. The meat remaining on the strainer is to be washed with a small quantity, say about a quarter of a pint, of hot water, which is added to the extract. The fluid thus obtained will be found possessed of a strong and peculiarly pleasant flavour of roast meat; a little salt and pepper may be added according to taste, and if found too strong it can be diluted with water. Should the food not be required for immediate use, it will keep well for a night or a day in the acid condition, and even thereby im-

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* I have tried to digest the meat in an earthenware pipkin, in order to save the trouble of removing it from the jar for the purpose of boiling it, but the temperature rose too high in the pipkin for the operation to be carried on properly.

prove; but the carbonate of soda should not be added before the food is required.

An important consideration connected with this process, is the fact that it does not require the use of any substance which is not naturally present either in cooked meat or in meat undergoing digestion in the stomach—the hydrochloric acid and carbonate of soda form common salt, which under any circumstances must be added to cooked meat, while the carbonic acid is entirely expelled by boiling, and pepsine is naturally formed in the stomach, and applied to the healthy digestion. I must be allowed to observe that the process I have described should not be adopted as a means of cooking meat for people in the enjoyment of health, as it is not natural that the stomach should be saved its habitual work. Gastric juice must be secreted, and pepsine formed from the blood circulating in abundance in the coats of the stomach during digestion; if the demand for gastric juice and pepsine is lessened from the fact that the food taken does not require them, it is very obvious that the blood in the coats of the stomach will not be relieved of that material which it ought properly to give out to food undergoing digestion, and a sensation of fulness may be thereby induced.

In conclusion, I think it right to state that should the food prepared by the above-described process not be found perfectly savoury and agreeable to the taste, it will be owing to one of the following causes:—

1st. To the meat not being quite fresh, when an unpleasant odour will be emitted from the hot contents of the jar.

2nd. To the acid fluid not having been carefully measured out, in which case the prepared food may be either acid or alkaline to the taste, according to the acid fluid having been added in excess, or in too small a quantity; under these circumstances a little more carbonate of soda or of the acid solution should be added, as the case may be.

3rd. The prepared food may be found to have a slightly saline taste, which is due to the carbonic acid of the carbonate of soda not being entirely evolved; this can be corrected by boiling the food a little longer.

4th. As fat during natural digestion in the stomach becomes partly acid, the meat used to be made into the prepared food may acquire, during the preliminary digestion, a slight unpleasant taste, from the fat it contains beginning to

undergo a similar change. For this reason, and also because fatty food usually does not agree with weak stomachs, I should advise the meat to be used free from fat, and whatever fat remains on the prepared food to be skimmed off. This I state merely as a measure of precaution, as I have not yet obtained any positive evidence that fat becomes acid when artificially digested.

5th. Any bitter taste may be removed by the addition of a little more salt.

I have used strips of calf's stomach instead of pepsine, which softens and dissolves the meat to a much greater extent; but I am not yet prepared to decide which is the best of the two methods. When no pepsine can be procured, I see no objection to the use of calf's stomach (the 4th stomach, commonly called the *reed*, being well washed and cut into strips free from fat) in the proportion of from one to three ounces for a pound of a meat, the fat being skimmed off the food before it is used. In other respects the process for the preparation of meat will be precisely as described above.

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